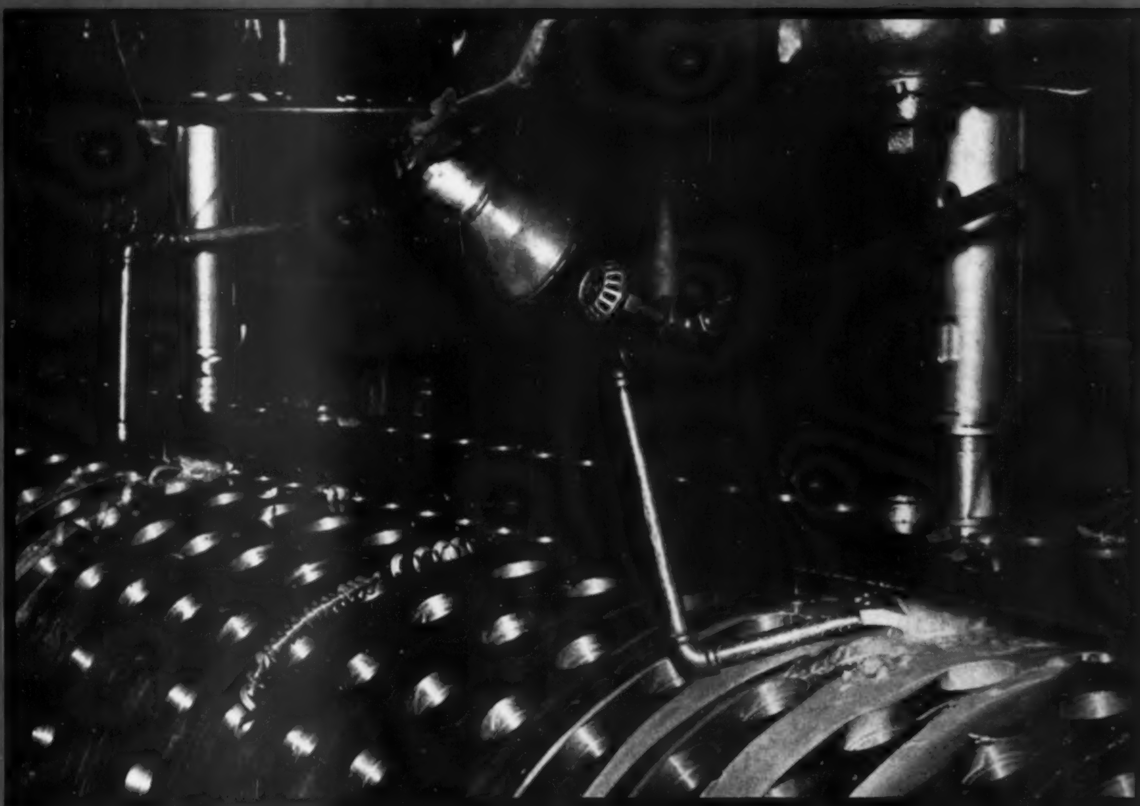
COMBUSTION

DEVOTED TO THE ADVANCEMENT OF STEAM PLANT DESIGN AND OPERATION

February, 1943



Drilling tube holes in large drum

Photo by H. R. Towse

Extension of LONGWORTH Steam Heating Plant ▶

Notes on Boiler Operation ▶

WITH ANY TYPE OF STOKER FIRING YOU CAN HAVE THE ADVANTAGES OF

V-U steam generator design

EXAMPLE NUMBER 4

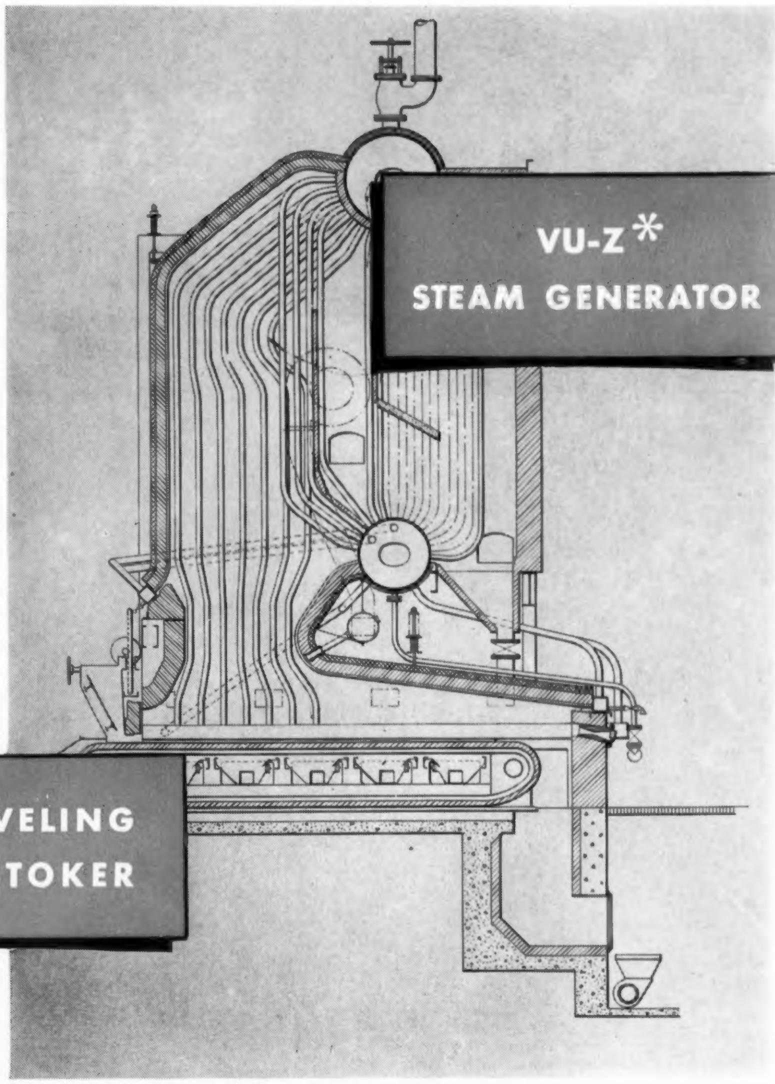
For the smaller sizes of anthracite, as well as for coke breeze and lignite, the traveling grate stoker has long been recognized as the ideal firing equipment.

The present design of *C-E Traveling Grate Stoker* stems from the widely known Coxe Traveling Grate, developed over 50 years ago. To date, 2500 of these stokers have been installed under an aggregate of more than 11,000,000 sq ft of boiler heating surface.

This stoker finds in the flexibility of furnace design, inherent in the VU-Z Steam Generator, all the requirements for its proper application, i.e. suitable arch arrangement, a well proportioned furnace area of ample volume and adaptability to the most desirable disposition of waterwall surfaces. Furthermore, the side wall headers for the water-cooled walls also serve as water boxes at the grate line.

The fine performance record of the VU-Z Unit is chiefly the result of its symmetrical arrangement of heating surfaces which assure uniform gas travel across the full width of the boiler and complete utilization of the furnace volume. This feature provides the most desirable conditions for stable combustion, effective heat transfer and high thermal efficiency. It also provides an evenly distributed steam release across the drum, assuring dry steam and an even water level.

Where fuel and load conditions are right, this combination of equipment is the best answer for the buyer who is primarily interested in low overall steam costs and a thoroughly reliable installation.



* *The VU-Z Steam Generator provides the advantages of Combustion Engineering's well-known VU Unit with a furnace and arrangement of heating surface especially adapted for stoker firing.*

A-714

COMBUSTION C-E ENGINEERING

200 MADISON AVENUE NEW YORK, N. Y.

COMBUSTION

DEVOTED TO THE ADVANCEMENT OF STEAM PLANT DESIGN AND OPERATION

VOLUME FOURTEEN NUMBER EIGHT

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FOR FEBRUARY 1943

FEATURE ARTICLES

EDITORIALS

DEPARTMENTS

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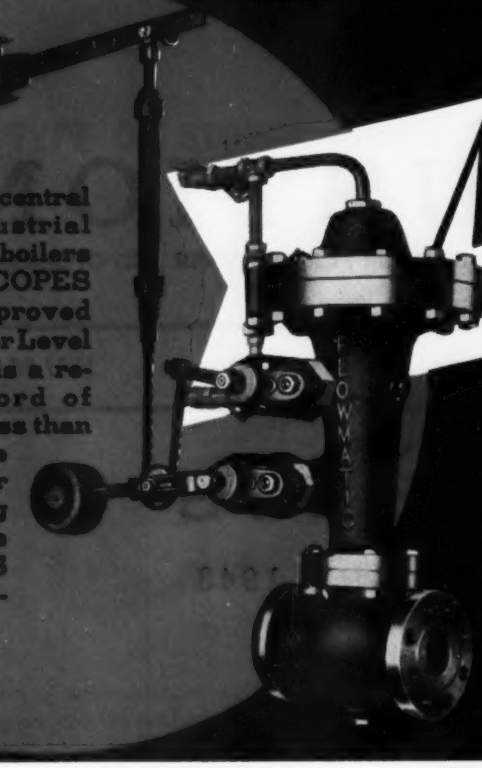

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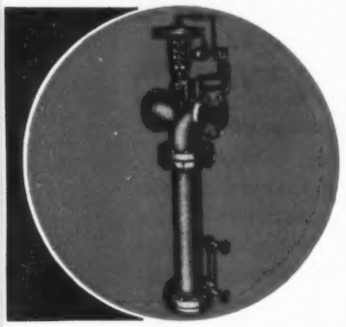

COPES Desuperheaters completely or partially remove the superheat from steam to be used for process or for auxiliaries designed for reduced temperature steam. This ruggedly built Desuperheater utilizes the spray principle. Sizes from 2" through 14"—Bulletin 405.

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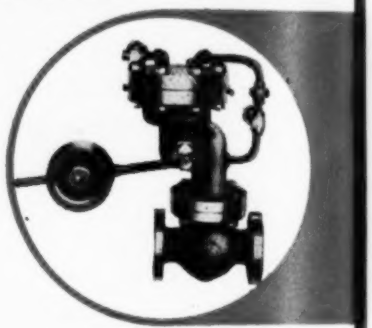
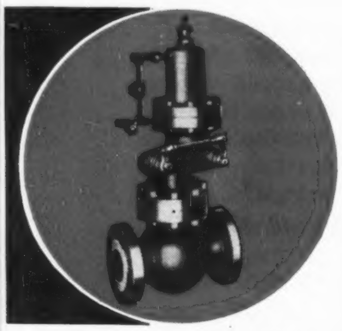


COPES Pump Governors



COPES Pump Governors control within close limits any excess pressure from 15 to 150 pounds. Used on simplex or duplex pumps and on turbine or motor-driven centrifugal pumps, sizes 1½" through 6". Write for bulletin.

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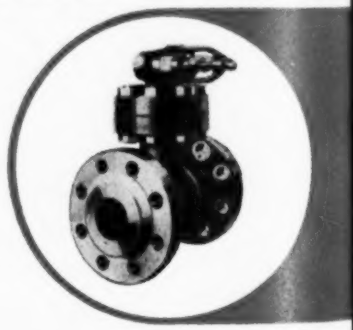

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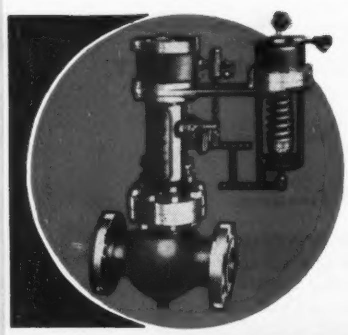

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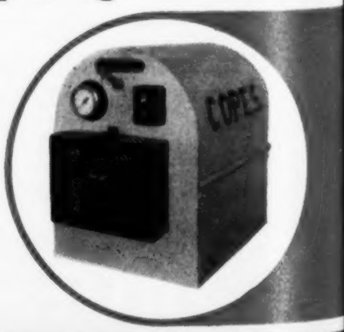


COPES FEED WATER REGULATORS AND ALLIED EQUIPMENT

NORTHERN EQUIPMENT COMPANY • 236 GROVE DRIVE, ERIE, PA.

EDITORIAL

Power Director Appointed

Most power men and others concerned with the supply of adequate power for war production will view with satisfaction the appointment of J. A. Krug to the newly created office of Power Director. In making this a separate division of WPB, reporting directly to Chairman Nelson, recognition is given to the importance of power and other utility services in the expanded production program for 1943.

Mr. Krug's previous administration of the WPB Power Branch inspired confidence in his ability to cope rationally with problems as they arose. Moreover, he showed a disposition to select as assistants men with practical experience in the power field. In the capacity of Power Director, his broader responsibilities and increased authority should serve to avoid the confusion that previously resulted at times from attempted encroachments by other governmental agencies having to do with certain phases of power supply and regulation.

There are indications that Mr. Krug will have the full backing of Chairman Nelson in carrying out the duties of this office.

Water Lancing Advocated in Britain

The wartime fuel problem in England appears to have focused attention on the slagging of furnace walls and superheaters as a hindrance to continuous operation at high ratings for long periods; hence the British technical press has lately given prominence to recommendations of the Boiler Availability Committee for water lancing as a means of increasing boiler availability. This committee, it may be mentioned, is made up of representatives of power companies and boiler manufacturers.

Water lancing has been practiced by some companies in this country for several years, although opinion among operators is divided as to its advisability, many preferring steam or air for this purpose. Unquestionably, water will remove slag accumulations, but it must be applied with discretion and proper supervision, lest damage be incurred. It is most important that the jet be kept in motion and that impingement on headers and hangers be avoided.

Should the jet be kept in contact with the tube for a brief period after the slag has become detached and fallen off, the water will cause some drop in the temperature of the tube; and as soon as the jet is removed, the temperature of the tube will rise rapidly to a value much higher than when it was covered with slag. The resulting contraction and expansion, particularly in the case of straight tubes, is likely to cause loosening of the joints in the header, the position of which is fixed by the adjacent tubes.

Attempts, in some cases to water lance superheaters have been disastrous, and should be discouraged.

It is suggested, therefore, that British engineers keep these possibilities in mind and exercise necessary precautions and strict control where adopting this method of deslagging. The wide application of water lancing to industrial plants, as advocated editorially by one magazine, would seem highly questionable as many such plants lack the necessary expert supervision.

Turbine-Electric Drive

Turbine-electric drive for ship propulsion, which had its inception in the mind of the late W. L. R. Emmett, was first applied to a sizeable commercial vessel about thirty years ago. The outbreak of World War I found several naval vessels so equipped and in the post-war period it was applied to several capital ships, as well as to the airplane carriers *Lexington* and *Saratoga*. In the succeeding decade, numerous small vessels and a few large merchant ships, notably the ill-fated *Normandie*, were so equipped.

For a time there were indications that turbine-electric drive might predominate, but steady developments and refinements in gear drive served to stem a trend toward electric propulsion. Each had its advantages, disadvantages and proponents, but the fact that shipbuilding in this country remained nearly dormant for a period of fifteen years may have been largely responsible for the subsidence of this once much-discussed topic, outside of strictly marine engineering circles.

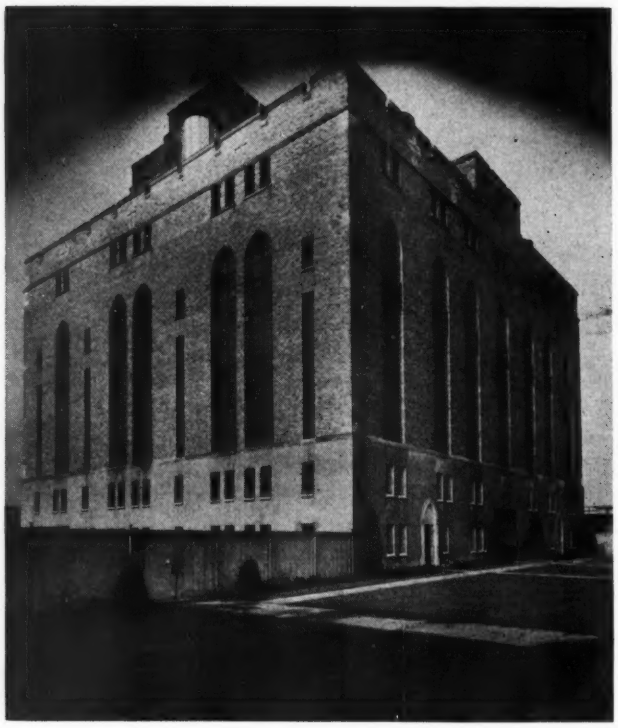
Therefore, it is of interest to note in the year's review of developments and work done by the General Electric Company, that a large number of tankers and a few cargo and passenger vessels, built or building, have turbine-electric drive.

The propulsion machinery of certain types of war-emergency vessels, such as the Liberty Ships, was determined by expediency, but the performance of other types now building, that may be expected to take their place in post-war commerce, will provide a guide to future practice.

In the past few years, marine engineering has broken away from former conservatism in many ways; not only in methods of ship fabrication but it has profited by stationary experience in the employment of high steam pressures, high temperatures, combustion control, larger units, etc. Many changes have also been wrought in the arrangement of the propulsion machinery. Whether this will result in a further trend toward electric drive will depend upon its economic performance as compared with that involving the marked progress in gear drive.

With the return to normalcy, one may expect a revival of discussions on this subject.

Extension of LONGWORTH Steam Heating Plant at Dayton, Ohio



View of the completed enlarged station

By L. C. KILLEN

Manager of Heating Division

Dayton Power & Light Company

A review of the growth of the central heating system in Dayton and a description of the latest extension to the Longworth Street Steam Station which now contains three stoker-fired units having an aggregate maximum capacity of close to half a million pounds of steam per hour. Of particular interest is the performance of the last two units which have operated over long periods with over 84 per cent efficiency and show stoker maintenance of less than 2 cents per ton of coal burned with a preheated air temperature around 350 F.

IN 1906, the predecessor of The Dayton Power and Light Company inaugurated a low-pressure steam heating system in the downtown section of the City of Dayton, Ohio. Exhaust from several small Buckeye engines, driving d-c generators and Brush arc machines, was used as the heating medium, and the area served consisted of only two by three blocks.

As time went by and more efficient electric generating equipment became available, a new generating station was erected by the present company to the south of the city, leaving the two old plants to serve the heating system, which was rapidly growing, both as to the territory covered and the number of customers served. Because of the greater distances involved, the steam-heating system was gradually changed from exhaust to all live steam.

In 1920 an appreciable factory heating and domestic steam load was responsible for the first section of what is now a tie line between the Third Street Station and the present Longworth Street heating plant. This first section was totally welded, even to the extent of welding expansion joints, shut-off valves, drips, etc., into one homogeneous whole. The last link of this tie line was completed in 1936. From this high-pressure live steam line, the steam is taken direct to factories and larger buildings for heating and other purposes. At various points in the line are located steam bleeder stations, some remotely controlled, for bleeding high-pressure steam direct to the low-pressure network. The latter has now grown to approximately fourteen miles of underground mains, serving some $2^1/_2$ million square feet of radiation and which, for the year 1942, accounted for about a billion and a quarter pounds of steam. Some 30 per cent of the steam sold is metered by flow-type meters and the remainder by meters of the condensation type.

Reverting to 1929, the growth of the heating load at that time indicated the advisability of erecting a new steam-generating station. As the downtown section of the city is bounded on two sides by the Great Miami River, it became necessary to locate the new plant, known as Longworth Street Station, on the east side of the downtown heating system. A site, approximately 450 ft square, was procured at the corner of Perry and Eaker Streets, this site being logical both because of its proximity to the heating system and adjacent railroad facilities for the delivery of coal. Also, it was known to be underlaid with an abundance of water which could be used for boiler feed.

The Longworth Street Station was laid out to be built in three sections, as needed, each containing two boiler units. The first boiler was put into service in the fall of

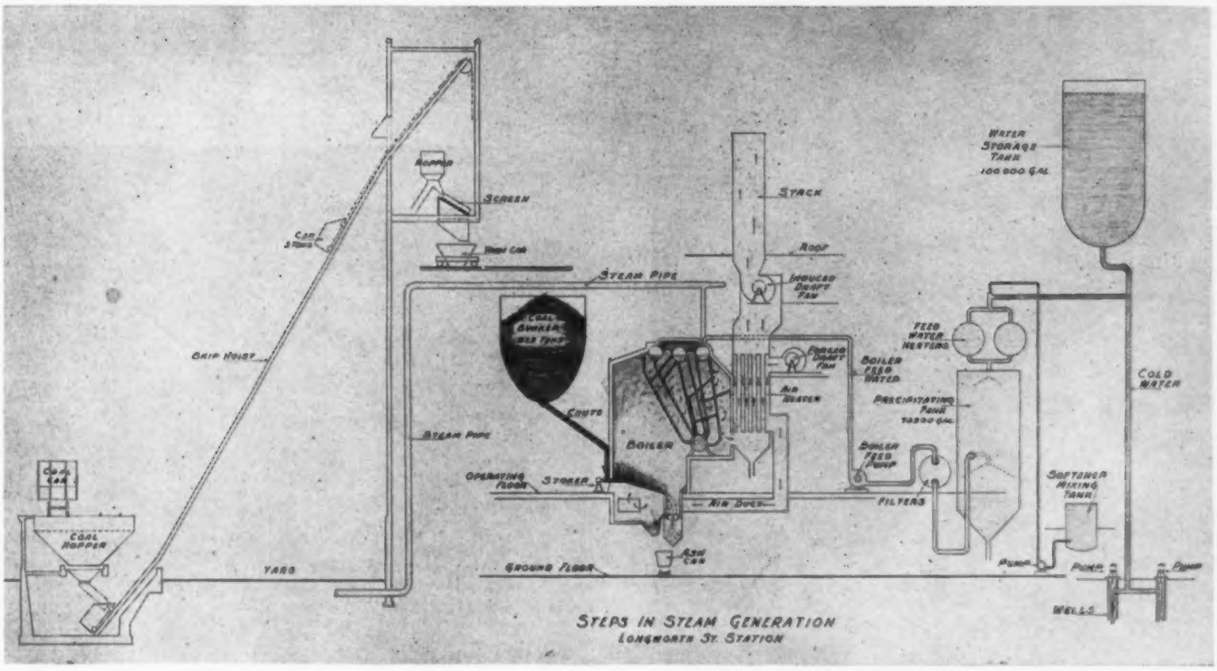


Diagram showing the steps in steam generation at this plant

1930, the second in 1937 and the third in 1942. The first section of the building included sufficient coal bunker capacity (800 tons), trackage, coal-skip and ash-skip hoists, precipitating tank, and heater capacity to accommodate four boiler units. Hence the building of the second section was simplified. Each of the units installed thus far is stoker-fired.

Eastern bituminous coal is burned. This averages around 13,500 Btu per lb., 34 per cent volatile, 9.8 per cent ash, 1.12 per cent sulphur and has an ash fusion temperature of about 2300 F.

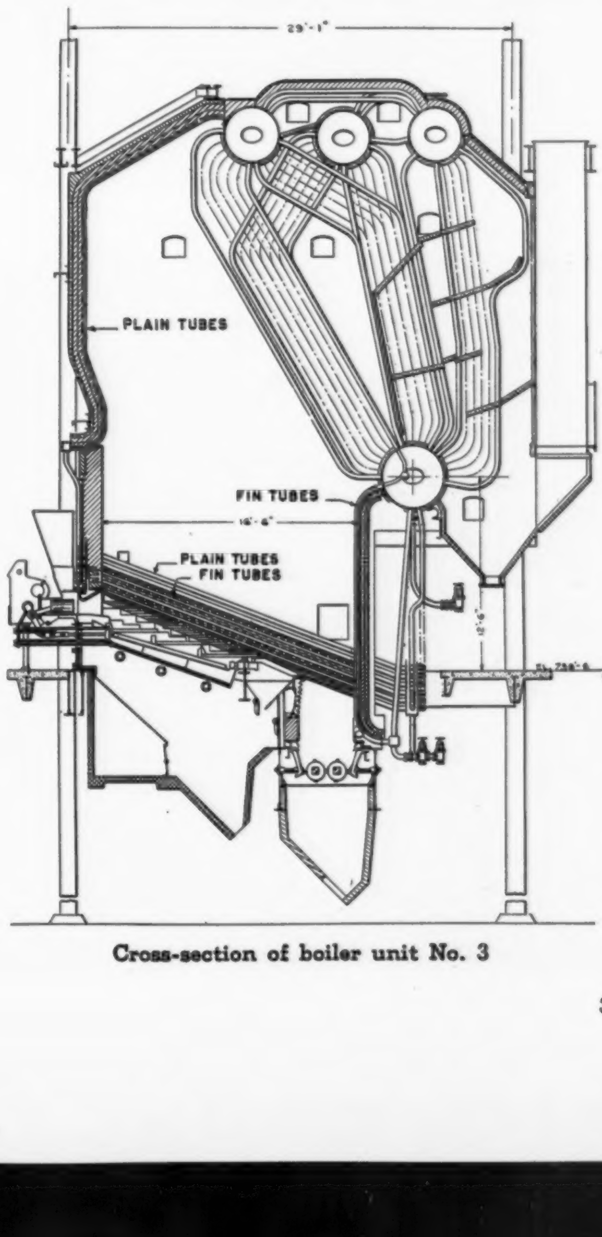
The second unit, which has now been in service for about five years, is a C-E four-drum bent-tube boiler fired by a C-E multiple-retort underfeed stoker of the clinker-grinder type. It is provided with a tubular air preheater and equipped with both forced- and induced-draft fans, both turbine-driven. Inasmuch as the steam is all employed for heating, a superheater is not included. The unit has a continuous rating of 155,000 lb of steam per hour, or 170,000 lb for four hours, with feedwater at 200 F and 200 lb operating pressure.

The furnace of this unit, which is $16^1/_2$ ft front to rear and 19 ft 4 in. wide, has a refractory front wall, refractory side walls with water-cooled clinker chills at the sides of the stoker and a plain tube rear wall, covered with blocks for a distance of about six feet above the lower header. The boiler was originally baffled for three passes; but, in order to reduce the exit gas temperature, it was later rebaffled for five passes, as sufficient fan capacity was available to take care of the increased draft loss. This change resulted in boosting the overall efficiency of the unit beyond that originally guaranteed.

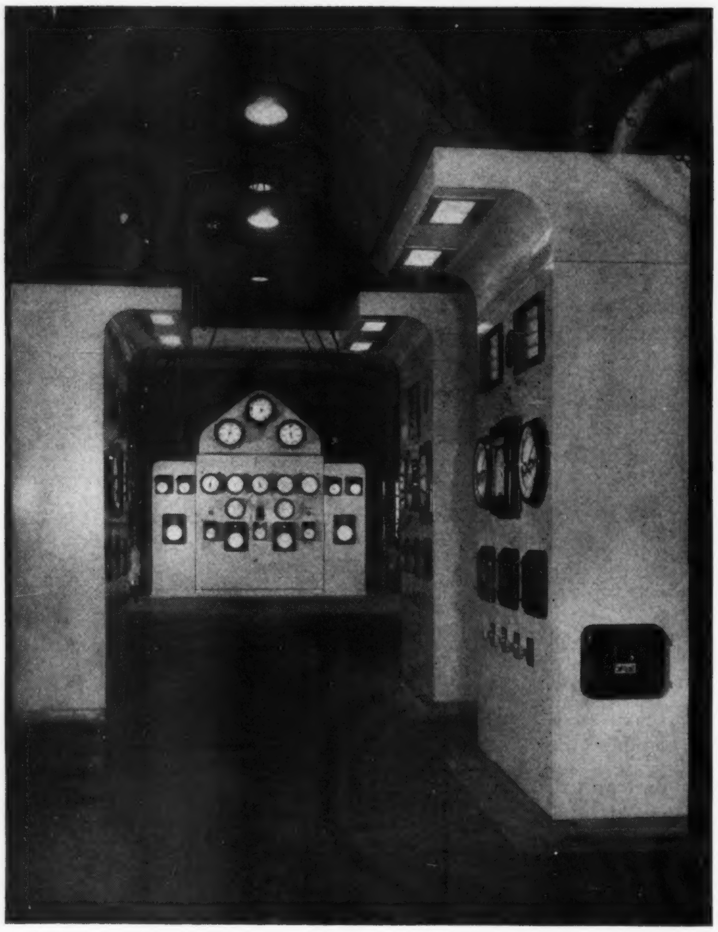
The stoker, of eleven retorts, has dual steam-turbine and four-speed motor drive, and a Hele-Shaw hydraulic drive operates the double clinker grinders. A Leeds & Northrup system of combustion control is employed.

Operating performance over long periods showed an overall efficiency of around 84 per cent and an average stoker maintenance, covering labor and materials, of less than two cents per ton of coal burned. This latter figure included the cost of making changes in the secondary rams because of operation with air preheated to 360 F.

In the spring of 1941, negotiations were completed and contracts let for the second section of the station and the

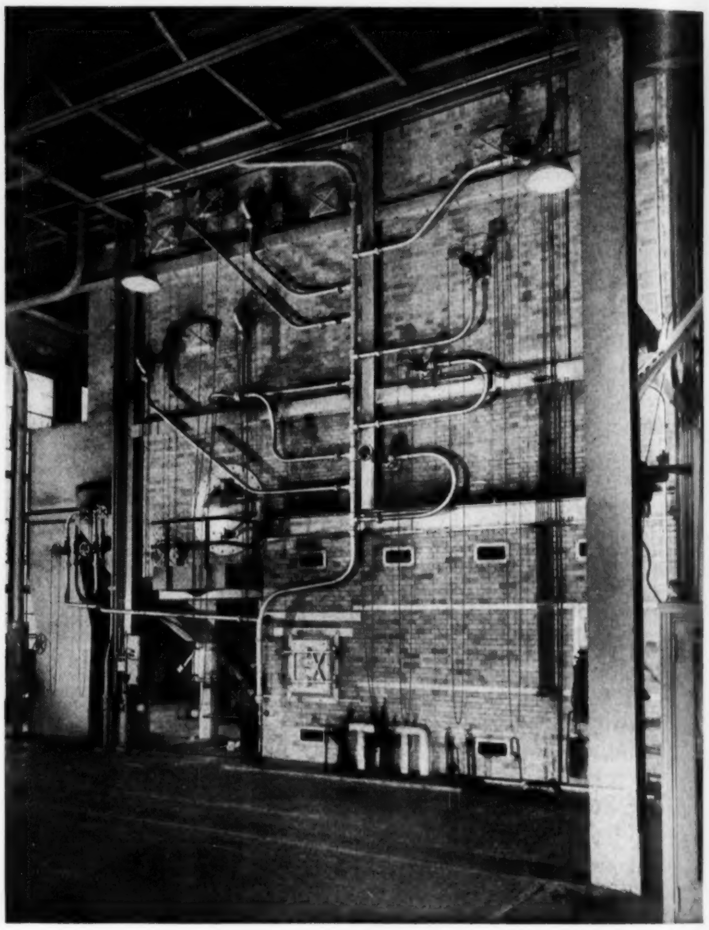


Cross-section of boiler unit No. 3

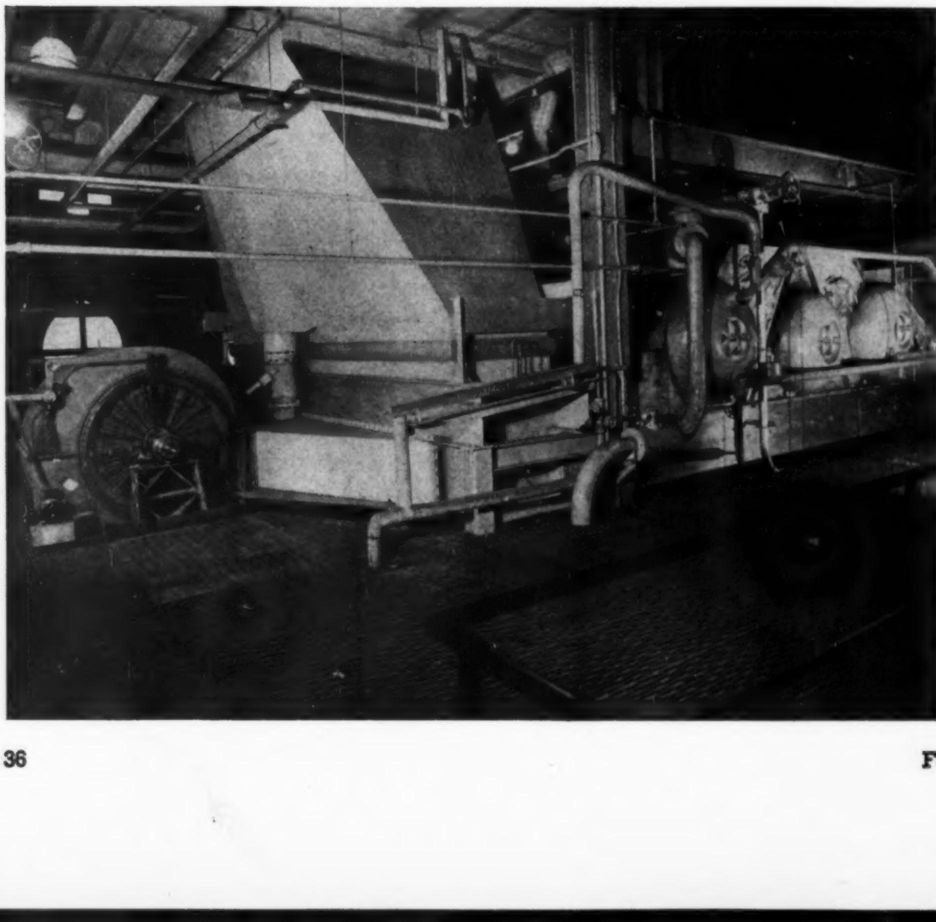


View of firing aisle showing individual control panels for each of the three boilers, and the master meter board at end of aisle which measures and records the steam leaving the station

Longworth

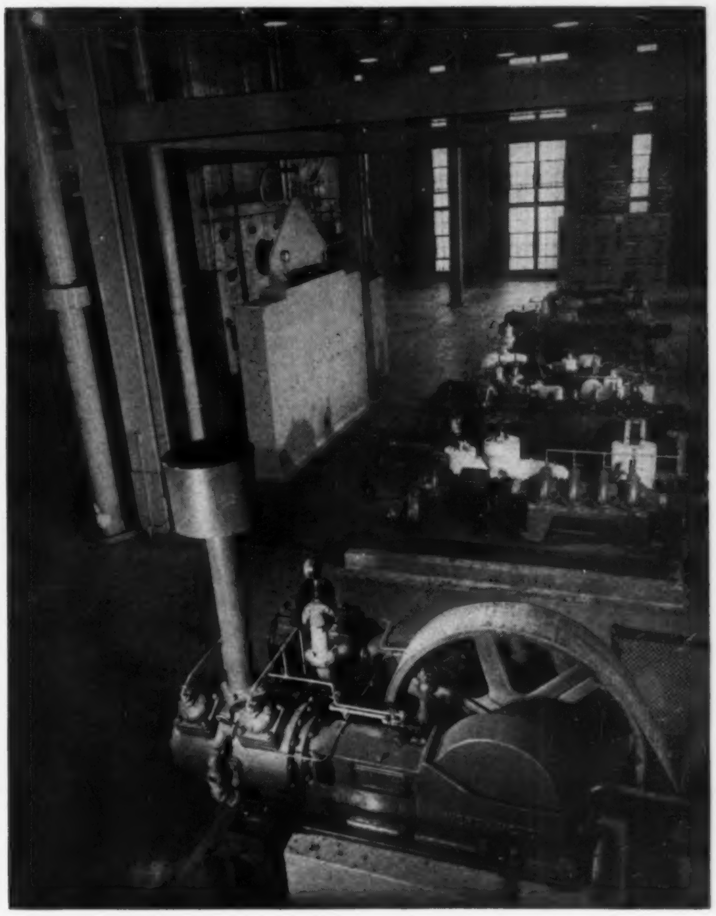


Side elevation of completed boiler unit No. 3

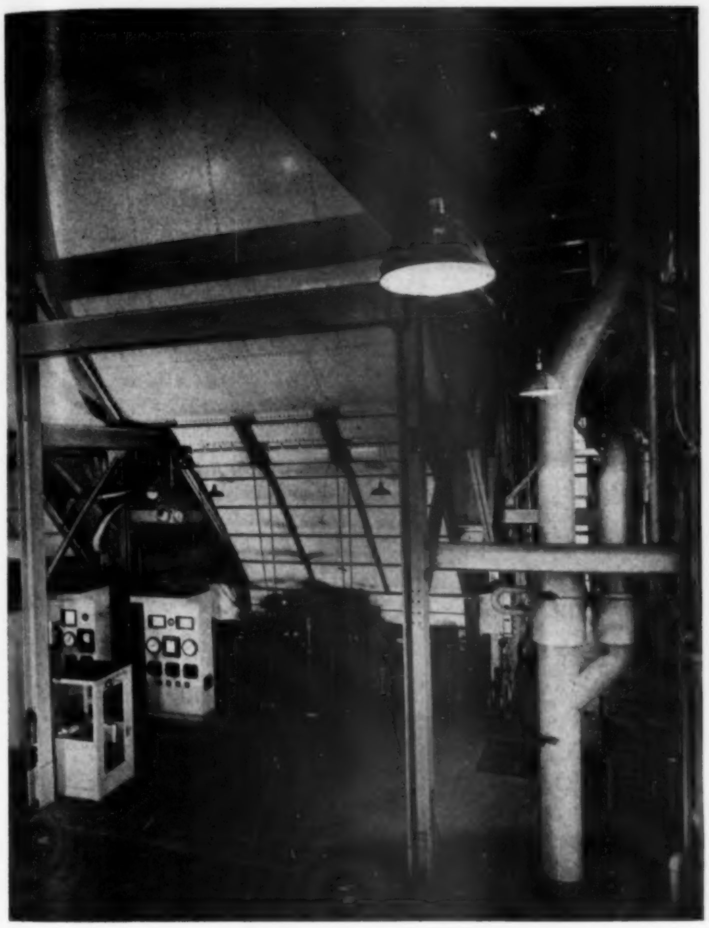


Forced-draft fan for boiler unit No. 3

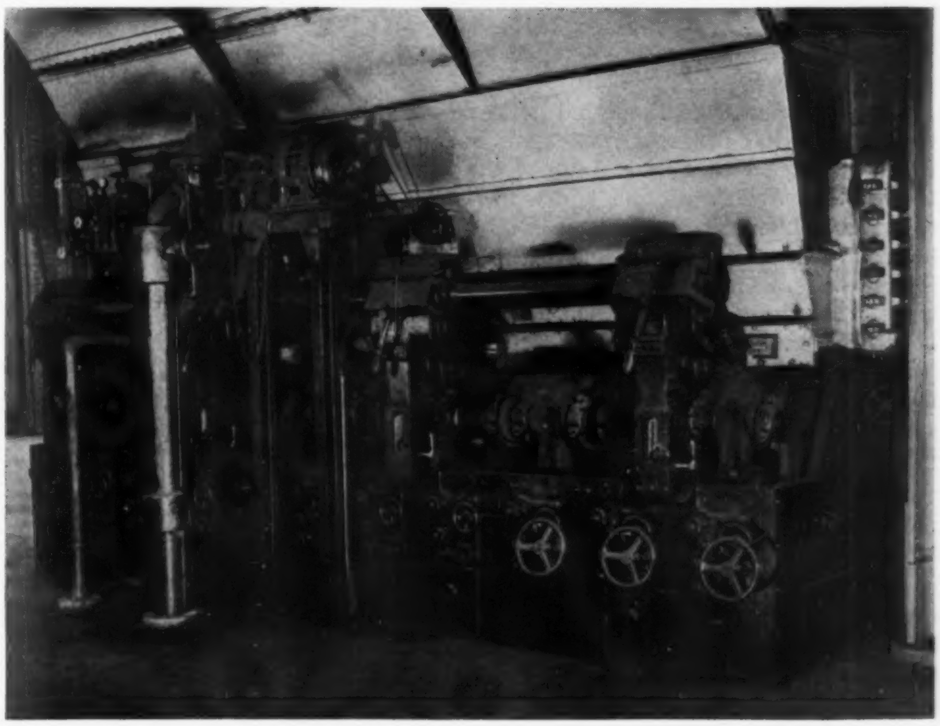
Extension



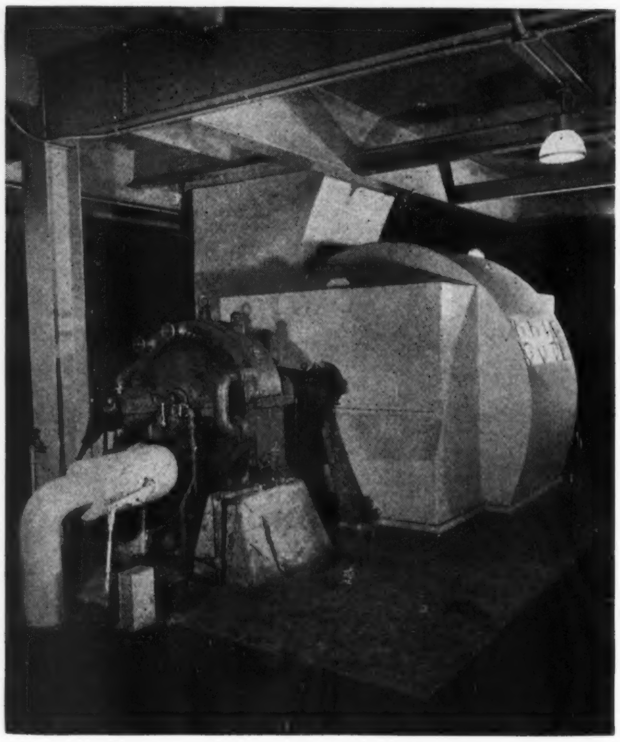
View of air compressor and four (4) boiler feed pumps



Front view of boiler unit No. 2



Front view of stoker under boiler No. 3



Induced-draft fan for boiler unit No. 3

installation of the third boiler, designated as No. 3. This unit, which went into operation in October 1942, is practically a duplicate of the second boiler, with the changes in baffling incorporated. The principal differences are in the furnace. Whereas the earlier unit had plain tubes and blocks covering the lower part of the rear wall, the latest unit has fin tubes all the way down and plain tubes in the front wall; also instead of blocks, the clinker chills consist of inclined fin tubes at the sides of the stoker. Following is the comparative design performances:

	1937 Unit			1942 Unit		
Per cent rating	150	318	350	150	318	350
Overall efficiency	84.5	82.7	81.8	85.8	84.8	84
Gas from air heater, deg F.	350	460	490	340	415	440
Air from air heater, deg F.	310	360	365	290	335	350

All water of condensation is led to the city sewage system; hence 100 per cent makeup is required. This, which is taken either from wells or the city mains, is treated in a 70,000-gph lime-and-soda hot-process softener, the effluent from which is filtered through four horizontal filters operated in parallel. The filter medium is anthracite. Phosphate and tannin, properly proportioned, are admitted intermittently to the suction of the boiler feed pumps. With a view to preventing scale formation and carryover, the following conditions are maintained in the boiler water:

"B" reading	10.0 cc of $^1/_{10}$ N HCl/100 cc
Phosphate	40 to 50 ppm
Sulphates	1000 ppm
Chlorides	150 ppm
Total dissolved solids	Approximately 2000 ppm

The dissolved solids are maintained at the figure previously mentioned by means of continuous blow-down taken from the middle or the front drum. The blow-down is then passed through a heat exchanger, in which heat is recovered from the blow-down and absorbed by the incoming water to the softener.

OPA Approves Advance in Coal Prices

Action to put more of the nation's coal industry on a six-day production has been taken by the Office of Price Administration in issuing four more price schedules to cover increased production costs in bituminous coal mines in Pennsylvania, West Virginia, Maryland and Ohio. The new prices (f.o.b. mine) provide for increases in average mine realization from 18 to 25 cents a ton, and the increases will be passed on to the domestic and industrial consumers.

The greater part of the higher prices covers the cost of extending the five-day, 35-hr week to a six-day, 42-hr work period. The balance of the increase represents "creeping" production costs which have accumulated since maximum prices were established for bituminous coal last April.

The new schedules follow similar action for Districts No. 2 (Western Pennsylvania), No. 22 (Montana) and No. 25 (Washington and Oregon). In still other districts agreements for the work on the sixth day, which involves time and one-half and rate and one-half for time worked over 35 hrs, have been reached and schedules reflecting the costs of the extended operations will be issued shortly.

The Pennsylvania anthracite industry is already working under the six-day agreement.

The Office of Solid Fuels Coordinator for War has estimated the nation's wartime needs for bituminous coal at 600,000,000 tons annually which will require a full six-day work week to produce. The demand for anthracite is correspondingly high at 65,000,000 tons.

By districts the following approximate increases in average mine realization are reflected in the new maximum price schedules:

District No. 1 (Pennsylvania, Northeastern West Virginia and Maryland), 23 cents per ton.

District No. 3 (Northern part of West Virginia (Fairmont), 19 cents per ton.

District No. 4 (State of Ohio), 18 cents per ton.

District No. 6 (West Virginia panhandle), 19 cents per ton.

Further breaking down the cost of the sixth day worked and accumulated operational costs, including materials, supplies, taxes, the following table gives a contrast between costs per ton in April, 1942, and estimated costs at the present time:

District	Representative Costs as of April 1942[1]	Representative Costs as of September 1942[2]	Representative Costs as of the Present[5]	Estimated Cost Increases Since Issuance of Maximum Price Regulation No. 120
1	$2.4694	$2.5014 1.6384*a*[3] 0.1475*b*[4]	$2.6969	$0.2275
3	1.9918	2.0319 1.2247*a* 0.1102*b*	2.1820	0.1902
4	1.9966	2.0249 1.1228*a* 0.1011*b*	2.1777	0.1811
6	2.0466	2.0671 1.2377*a* 0.1114*b*	2.2380	0.1914

[1] The figures in this column represent the weighted average per net ton costs of operation incurred during the period January–June 1942.

[2] The initial figure for each district in this column represents the weighted average per net ton costs of operation for the period July–September 1942.

[3] Figures marked *a* represent the weighted average of the districts as labor costs for the period July–September 1942.

[4] Figures marked *b* are the representative increases in labor costs occasioned by the six-day week, and result from multiplying 9 per cent times the average labor costs for the period July–September 1942.

[5] The figures in this column result from adding to the figures shown in the first column for the costs as of April 1942 the amount shown in the second column as the labor cost increase, plus 8 cents per ton.

BEWARE THE ID(ES) OF FLOW

By WILLIAM C. BENNETT

Cochrane Corporation

REGARDLESS of the accuracy of a flowmeter as a differential pressure measuring device and despite the most scrupulous attention and care given to installing it properly, the results will be incorrect if the primary element, the orifice plate itself, is incorrectly calculated.

Incorrect computation should not occur because of any mathematical error by the flowmeter manufacturer, as all recognized makers in this field employ trained engineers equipped with calculating devices and the results are subjected to checks and double-checks. But there is a joker which lurks in the specification of the data to the manufacturer. It is the very innocent looking factor in the formula which is labeled "inside diameter of pipe line."

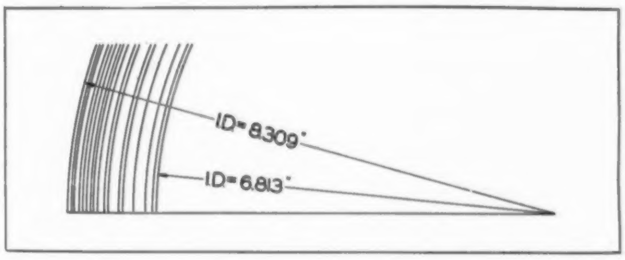


Fig. 1—There are actually 21 different inside diameters for 8-in. pipe as indicated above.

If one is desirous of obtaining maximum accuracy from a flowmeter installation, he cannot depend on a loose specification such as "8-in. standard pipe" or "10-in. extra heavy pipe." The inside diameter of the actual section of pipe used for the meter run must be carefully measured.

The catalog of one of the leading manufacturers of pipe fittings shows twenty-one different inside diameters for 8-in. pipe. Here is an excerpt from the complete table showing not only the new schedule number sizes but also older standards of size and wall thickness.

Schedule No.	Outside Diam., In.	Inside Diam., In.	Wall Thickness, In.
...	8.625	8.309	0.158
...	8.625	8.295	0.165
...	8.625	8.249	0.188
...	8.625	8.219	0.203
...	8.625	8.187	0.219
...	8.625	8.149	0.238
20	8.625	8.125	0.250
30	8.625	8.071	0.277
40	8.625	7.981	0.322
...	8.625	7.937	0.344
...	8.625	7.921	0.352
...	8.625	7.875	0.375
60	8.625	7.813	0.406
...	8.625	7.687	0.469
80	8.625	7.625	0.500
100	8.625	7.439	0.593
...	8.625	7.375	0.625
120	8.625	7.189	0.718
140	8.625	7.001	0.812
...	8.625	6.875	0.875
160	8.625	6.813	0.906

Each and every one of these sizes might be encountered on a job. Moreover, the actual size varies a little

WALL THICKNESS OF PIPE

(Courtesy of Tube-Turns, Inc.)

Nominal Pipe Size, In.	Outside Diameter, In.	Schedule 10	Schedule 20	Schedule 30	Schedule 40	Schedule 60	Schedule 80	Schedule 100	Schedule 120	Schedule 140	Schedule 160
2	2.375	...	...	...	0.154	...	0.218	...	...	...	0.343
2 1/2	2.875	...	...	...	0.203	...	0.276	...	...	...	0.375
3	3.5	...	...	...	0.216	...	0.300	...	...	...	0.437
3 1/2	4.0	...	...	...	0.226	...	0.318	...	...	...	...
4	4.5	...	...	...	0.237	...	0.337	...	0.437	...	0.531
5	5.563	...	...	...	0.258	...	0.375	...	0.500	...	0.625
6	6.625	...	...	...	0.280	...	0.432	...	0.562	...	0.718
8	8.625	...	0.250	0.277	0.322	0.406	0.500	0.593	0.718	0.812	0.906
10	10.75	...	0.250	0.307	0.365	0.500	0.593	0.718	0.843	1.000	1.125
12	12.75	...	0.250	0.330	0.406	0.562	0.687	0.843	1.000	1.125	1.312
14 O.D.	14.0	0.250	0.312	0.375	0.437	0.593	0.750	0.937	1.062	1.250	1.406
16 O.D.	16.0	0.250	0.312	0.375	0.500	0.656	0.843	1.031	1.218	1.437	1.562
18 O.D.	18.0	0.250	0.312	0.437	0.562	0.718	0.937	1.156	1.343	1.562	1.750
20 O.D.	20.0	0.250	0.375	0.500	0.593	0.812	1.031	1.250	1.500	1.750	1.937
24 O.D.	24.0	0.250	0.375	0.562	0.687	0.937	1.218	1.500	1.750	2.062	2.312
30 O.D.	30.0	0.312	0.500	0.625	...	...	...	...	...	...	...

from these figures since there is some manufacturing tolerance. Hence, there is an almost indefinite number of internal pipe sizes on the market.

It is not quite as bad as this list of twenty-one possible inside diameters would suggest, however, because in the sizes 2 to 10 in., inclusive, Schedule 40 exactly corresponds to the old terminology "standard pipe." Likewise, Schedule 80 exactly corresponds to the obsolete name "extra strong pipe" in sizes from 2 to 8 in.

A complete tabulation of present-day pipe standards as regards wall thickness is given below. Although 2- and $2\frac{1}{2}$-in. pipe sizes are included, for accurate flow measurement, a factory assembled orifice pipe assembly is recommended for all line sizes below 3 in. These pipe assemblies are made up of a sufficient length of carefully inspected seamless steel tubing and eliminate errors caused by pipe eccentricity, off center orifice location, incorrect tap locations as well as inaccurate determination of internal diameter.

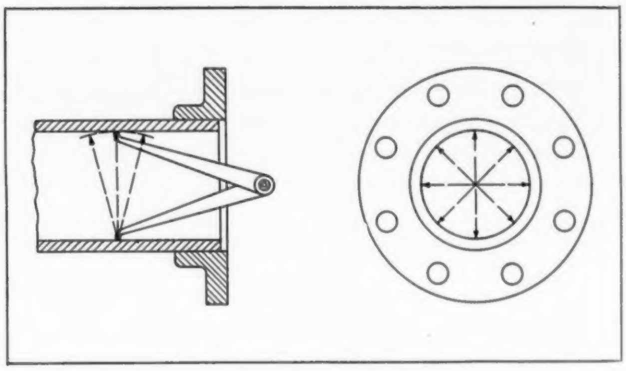


Fig. 2—Using internal calipers, measure the inside diameter by means of four diagonals at both the upstream and downstream taps. Average these eight dimensions in supplying data to the flowmeter manufacturer.

To show how serious a metering error can be due to incorrect internal pipe size, the following case was recently brought to light:

Specified I.D.	= 2.067 in.	Actual measured I.D.	= 1.939 in.
Orifice ratio	= 70 per cent.	Corrected orifice ratio	= 74.7 per cent.
Orifice bore	= 1.447 in.		
Flow factor	= 100 units.	Corrected flow factor	= 109.4 units.

An error of 9.4 per cent was occasioned by use of the wrong internal pipe diameter.

Measured internal diameters therefore *must be secured* for really accurate metering. Using internal calipers and a steel rule, measure the internal diameter of the pipe by means of four diagonal measurements at the locations of both the upstream and downstream taps. The average of these eight measurements can be used as the I.D. in furnishing data to the flowmeter manufacturer.

Often the accuracy of a metering installation falls off after a period of service from no apparent cause. This action can sometimes be traced to the formation of a layer of sediment or scale on the inside of the pipe causing a decrease in the actual flow area. This has the same effect as a wrong pipe diameter. When measuring dirty or contaminated fluids, one should be on the lookout for this condition.

Some Notes on Operating Boilers—Particularly Marine

WHILE it has been the practice of some plants to prescribe explicit instructions for boiler operation, in many others the procedure has been left largely to the experience and judgment of the individual operators. This, together with varying conditions encountered in stationary practice, has resulted, heretofore, in a scarcity of printed matter on the subject. At present, however, the necessity for rapidly training a very large number of inexperienced operators to handle marine boilers for our vast shipbuilding program, has resulted in the preparation of definite instructions. These differ in certain details to conform to the equipment involved, but are basically similar. The following notes, based on such instructions with some details omitted, may appear elementary to experienced operators, but will serve to emphasize certain points that are sometimes overlooked. Moreover, while applying particularly to oil-fired marine boilers, much of the material is fundamental to stationary plants, many of which have found it necessary to break in new operators because of the man-power shortage.

Starting a Boiler

If the boiler has been shut down and left filled with water, the first step before firing is to open the superheater vent and drain valves; then drain the superheater. When the latter is empty, close the drain valves and outboard header vent and leave open the superheater vent on the main steam valve. Drain the boiler through the bottom blowoff until the water disappears from the bottom of the lower gage glass. Refill to the bottom of the glass, using the auxiliary feed line for this purpose to make certain that it is operative.

On the other hand, if the boiler has been drained upon shutting down, the procedure upon starting up is first to close the bottom blowoff valve, the surface blow valve, water-wall drain valves (if the furnace is water cooled), the superheater and header drains and the water-gage drains. Next, check and open the steam pressure gage valves, the steam drum vent, superheater vent, economizer outlet header vent and water-gage valves; and begin to fill the boiler, preferably through the auxiliary feed line. As soon as water issues from the economizer vent valve, close the latter and continue filling the boiler until water appears in the bottom of the gage glass. Then bring the water level up to 2 or 3 in. by means of the main feed line.

If the boiler is equipped with automatic combustion control, this should be set on "manual" operation and the forced-draft damper operated by hand. *Never attempt to light off the fires on automatic* control.

Specific instructions for operating the fuel oil supply will depend upon the system employed and the manufacturers' instructions should be followed explicitly. However, a few general observations are in order.

After making sure that the burners have the proper size atomizer tips for starting operation, start the blower at low speed and open the air registers to ventilate the furnace. Then close the registers on the burners that are not to be lighted and light off one burner by means of the ignition torch. The air should be adjusted to render combustion as complete as possible, although at this stage of operation it may be difficult to eliminate smoke entirely when the furnace is cold.

It is most important that no unburned oil or vapor accumulates in the furnace or boiler passes, as this may tend to produce an explosive mixture after the increased temperature has vaporized oil that has accumulated on the tubes. For this reason, too much air pressure should not be employed at the burner as it will produce a chilling effect and allow unburned oil or vapor to deposit on the tubes. If white smoke is noted, reduce the air pressure immediately.

Where possible, plenty of time should be allowed for bringing the boiler to working pressure (preferably about three hours when the pressure is around 450 lb). Keep the boiler starting valve wide open, with steam blowing to atmosphere until the pressure is up to about 25 lb., above which the valve can be throttled down slowly until, at 400 lb, it is one-quarter open. In no event should the valve be less than one-quarter open, until the boiler is carrying load. *The superheater vent must be kept open while* the boiler is being brought up to pressure and, if the steam temperature rises above normal, the superheater vent should be opened wider or the firing rate decreased.

As the boiler pressure approaches header pressure, crack the main steam stop-check valve, open drains between the stop-check and then the main steam manifold valves to warm up the connecting line. Crack the auxiliary steam stop-checks and warm up the connecting lines to the auxiliary manifold. The safety valves should also be checked.

After the boiler pressure has been equalized with the header pressure, the main and auxiliary stop-checks should be opened and the boiler cut into service. As soon as the boiler is carrying load, close the starting valve.

The proper service tips are then inserted in the burners and the number required are lighted off. After the boiler has begun to carry load, the air preheater soot blowers should be placed in operation. The boiler can then be put on automatic control.

Stack gas temperatures should be watched during the starting-up period, particularly where an air preheater is employed, as unburned oil vapor or soot deposits on these surfaces may ignite and cause a fire which will be indicated by an abnormal rise in temperature of the gases leaving the air preheater. If this should occur, shut off the burners, close the air registers, shut down the draft blower and close the damper, then turn steam on the soot blowers to smother the fire. A steam lance may be of assistance in quenching the fire, but *in no case use an air lance.* Use of a CO_2 fire extinguisher may be necessary. Do not attempt to light off again until all combustible matter has been cleaned from the air preheater.

Shutting Down

When preparing to take a boiler out of service, reduce the load as slowly as conditions will permit and shift from automatic to manual control. Shut off the burners, one at a time. Then crack the starting valve, throttling to prevent dropping the pressure more than 100 lb per hr. Reduce the burner front pressure to approximately 1 in. w.g. and keep the forced-draft fan running until all combustible vapors are removed. Operate the soot blowers and close the furnace.

Close the main and auxiliary stop-checks and, if a desuperheater is employed, close its outlet valve. Maintain the water level at above 2 in. in the bottom of the gage glass.

About three hours after the fires have been extinguished the forced-draft fan may be started with the damper and air registers partly open to assist in cooling the unit.

When the steam pressure has dropped to about 50 lb, the superheater vents and drains should be opened, also the desuperheat drain; and, when the pressure is down to atmospheric, the steam-drum vent should be opened. If the boiler is to be opened for inspection, it is best to allow it to cool to about 150 F before draining. Avoid the practice of partially draining and refilling with cold water to cool the boiler.

Operating Suggestions

If, for any reason, the fire is lost, shut off the oil supply and return-oil valves, and switch to manual control. Reduce the burner front pressure and, before relighting, allow the furnace to clear of combustible gases. Use the torch for relighting and, under no circumstances, attempt to relight from hot brickwork. Do not switch back to automatic control until normal working conditions are restored.

Smoke is caused (1) by improper oil pressure or temperature; (2) by the return-oil pressure being out of proper range for the tip size; (3) by individual burner oil supply or return-oil valves throttled; (4) by dirty atomizer tips; (5) by non-uniform register setting; (6) by dirty, warped or broken air register doors; (7) by air leakage through a burner register not in service; (8) by spalled, coked, or distorted refractory burner throats; or (9) by incorrect air-fuel ratio adjustment on the combustion control.

With constant load, superheated steam temperature will rise above normal if the excess air is too high, if the feedwater temperature is too low and if flame is entering the superheater or secondary combustion taking place in the superheater. On the other hand, the steam temperature will be below normal if the excess air is too low, the feedwater temperature above normal, excessive moisture is being carried over from the steam drum, if the superheater elements are fouled, if the steam pressure is low or if the setting is below normal temperature. Priming, due to excessive alkalinity or too high total solids in the steam will cause the steam temperature to drop suddenly and recover. Of course, normally, steam temperatures tend to increase or decrease as the load rises or falls, unless means are provided for temperature control over a given operating range.

Stack gas temperatures will be higher than normal if the excess air is too high, if the heating surfaces are fouled and if secondary combustion is taking place in the passes or a fire starts in the air preheater. They will be below normal if the excess air is too low.

Chile to Study Coal Utilization

Americo Albala (center), consulting engineer in the Ministry of Economics and Commerce of Chile, and executive secretary of the Pan American Institute of Mining Engineering and Geology, has been commissioned by the Chilean Government to spend 18 months in the United States to study ways of utilizing coal. The first ten months he is spending in the fuel technology laboratories of the Pennsylvania State College. His investigations are under the supervision of Dr. A. W. Gauger (left), director of the Mineral Industries experiment station and head of the Department of Fuel Technology, and Dean Edward Steidle (right), who heads the School of Mineral Industries at the College.

Chile has the best, and practically the only good coal in the Spanish American countries, but it has no gas and no oil. The purpose of Mr. Albala's study is to ascertain methods of converting coal into the liquid fuels and metallurgical coke which Chile is now forced to import.

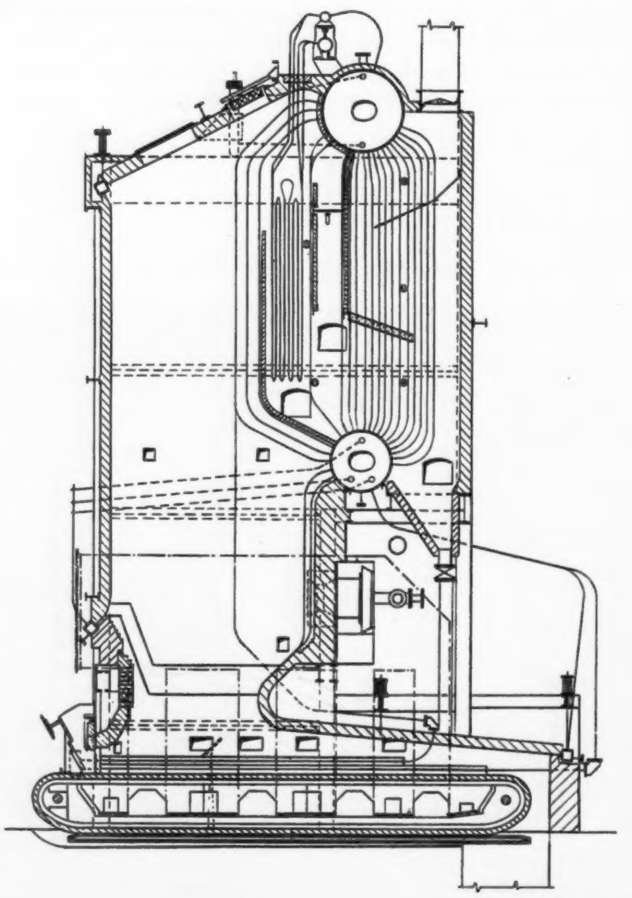
Combination Gas and Stoker Firing

AN INTERESTING installation for the combination burning of coke breeze and coke-oven gas was placed in service some months ago at one of the large coke-oven plants in the Middle West. It represented an extension to the existing low-pressure power plant, the steam from the new boilers being employed in a back-pressure turbine. Exhaust from this turbine, together with steam from the low-pressure boilers, is used to meet process requirements.

The extension to the boiler plant consists of three two-drum bent-tube steam-generating units, one of which is fired with gas alone and the other two with gas over traveling-grate stokers. Coke-oven gas, with a heating value of 530 Btu per cu ft, is the primary fuel and is used with all the units to the extent of its availability. Each unit, however, is designed to produce rated output on either fuel alone, and the gas-fired unit is arranged so that a stoker may be readily added, should the supply of coke-oven gas become limited.

The coke breeze has a heating value of 10,800 Btu per lb, averages about 6 per cent moisture and normally is of a size such as to pass through a $^5/_8$-in. screen.

Each steam-generating unit is rated normally at 45,000 lb per hr (50,000-lb maximum) and 650 F steam temperature at the superheater outlet, the superheater being of the interbank type with bypass damper control for the gases. The feedwater temperature is maintained at about 250 F. A steam washer of the bubble type is contained in each of the steam drums.



Sectional view of C-E two-drum unit arranged for firing with both coke breeze and coke-oven gas

The fin-tubes on the front wall with refractory backing are not clearly indicated in the sketch; the same applies to the rear arch. The section being taken through the middle of the unit, the far burner is shown dotted.

A long rear arch is employed over the stoker, together with a short front ignition arch. Gas is admitted through two horizontal turbulent burners located about midway between the bottom drum and the rear arch. The furnace of the gas-fired unit has fin tubes on the front wall and refractory for the sides and rear walls, whereas in the combination units, fin tubes cover the front wall and rear arch, with refractory for the remaining wall surface, except that clinker chills are placed along the sides of the stokers.

The stokers are 11 ft wide by 21 ft long and each has eight air compartments, this number being necessary in order to reduce the entrance velocity with the air admitted at one side only. Drive for each consists of a d-c motor and variable-speed transmission. As will be seen by reference to the cross-section the setting is compact, as concerns floor space and ample furnace volume is secured by having the upper drum 16 ft above the stoker grate.

The gases from all three units discharge into a common stack 11 ft in diameter and extending 175 ft above the ground level. Because of the experience in another plant of the company, also burning coke breeze, induced-draft fans were omitted, but a forced-draft fan is provided for each unit. These fans are driven by steam turbines taking steam from the low-pressure header at 150 lb and exhausting to the process lines. Therefore, overload capacity is limited by the stack draft.

Automatic combustion control is applied to the stoker drive, the fan turbine and the uptake damper as well as the gas supply to the burners.

IMPORTANT

On January 30 a letter and return postcard were mailed to all COMBUSTION readers pointing out:

1. That, we were confident of finding means to meet the Government's request for a reduction in magazine paper stock and still be able to mail COMBUSTION to all *interested,* if such readers would indicate their desire to continue to receive it.

2. That the war has brought about many changes in personnel, in duties and in addresses; and that it is important for us to maintain our mailing list and records right up to date in this respect. A few other questions to complete these records were asked.

Thus far, the response has been both prompt and encouraging as to the number of cards returned. However, as is usual in such cases, some have delayed supplying this information.

If you are one of those who have not as yet replied, your cooperation in doing so will be greatly appreciated, to the end that the mailing list may be 100 per cent correct and that all wastage in circulation be avoided.

If you have mislaid the reply card, just drop us a note and we will supply another.

The above does not apply to paid subscriptions.

Facts and Figures

192,000 miles per second is the estimated speed of electrons in the 100-million-volt X-ray machine that has lately been developed in the laboratories of the General Electric Company.

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The heat of combustion in a pound of TNT is approximately half that in a pound of coal. It is the time element in the release of this stored-up energy that accounts for the destructive effect of the former.

•

During 1942 the use factor for the total installed generating capacity for public use in the United States is reported to have been 47.3 per cent. That is, the output of electricity, from all sources, was 47.3 per cent of what it might have been, had all the capacity been operated at rating 24 hr a day for every day in the year.

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It is difficult to comprehend such a vast sum as the hundred billion dollar budget recently submitted by the President. However, if we visualize a 4-ft cube of pulverized coal, ground to the usual fineness and with each tiny particle representing a dollar, the picture is comparable.

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According to reports from the Federal Power Commission, electric utility plants, for the country as a whole, burned $15^1/_2$ per cent more fuel oil in December 1942 than in November, despite many conversions to coal.

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In the enormous expansion of welding as applied to war work, much electrical energy has been conserved by the increased use of alternating current. This, in turn, has also been responsible for saving copper.

•

Statistics from the British Electricity Commission show an average fuel cost of 0.156 *d* per unit of output for those stations operated under the direction of the Central Electricity Board, as compared with 0.118 *d* for those operated independently. This advantage was not maintained, however, as to overall costs per unit of output, due to higher salaries, wages and maintenance in the case of the latter.

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Inasmuch as 95 per cent of the weight of every motor is iron, steel, aluminum and copper—all critical materials—WPB urges all manufacturers who may have motors that are idle in closed civilian goods plants, to make them available for sale so that they may be put to use in war production. Moreover, each purchaser desiring a new motor must certify that he has no idle motors that can be adapted, that he has endeavored to obtain a used motor from at least three dealers, that the motor is not desired for replacement, and that it is required for immediate use.

More About Patents, Trademarks and Copyrights

By LEO T. PARKER
Attorney, Cincinnati, Ohio

THAT relatively few inventors profit from their inventions is partly because so few have sufficient knowledge of elementary patent law to realize just how to obtain proper and legal protection against infringement of their ideas. First, it is important to know that patents are subdivided into several classifications. Obviously, the patent lawyer employed by the inventor can give correct advice regarding classification; so this matter need not be gone into here. However, it is important that all inventors be sufficiently familiar with the law to enable them to determine whether a new idea should be protected under patent, trademark, label or copyright. This will be reviewed briefly.

A label for a product must be in a sense artistic in design and arrangement and it cannot be copyrighted. Therefore, a printed form must be registered in the United States Patent Office. In other words, a label is registered in the United States Patent Office whereas a book and, all other matter except prints, are copyrighted in the Library of Congress.

The protection afforded by a copyright is substantially different from that afforded by a patent. In 210 U. S. 239, the court held that:

"The patent law protects the production and use of the creative conception reduced to practical shape in various forms; the copyright law protects the publication of copies in the form of substance of the particular creative conception in which it has been impressed by the author. The right secured by the Copyright Act is 'The right to that arrangement of words which the author has selected to express his ideas.'"

Another important point is that mere priority in time does not confer a monoply of copyright as there is a sharp distinction in this respect between copyrights and patents. Copyrights differ from patent rights because persons making, using or selling a patented article are guilty of infringing the latters patent, even though they may have themselves invented the same invention without any knowledge of the existing patent. However, the recomposition of material, without copying, is not an infringement of a copyright. In other words, the owner of a copyright is not entitled to prevent other persons from publishing the matter contained if such persons collect or invent the same thing independently.

In 298 F. 145, a very recently decided case, the Court said:

"An author's copyright is an absolute right to prevent others from copying his original collocation of matter or notes, and does not depend upon good faith. The law imposes no prohibition on those who independently arrive at precise copyright combination of word or notes."

Design Patents

In many instances a design patent may be obtained where, also, a copyright may be registered. Of course, the former offers greater protection.

From time to time reviews and interpretations of patent laws and decisions, as prepared by Mr. Parker, have appeared in these pages for the purpose of affording a better understanding of points involved. Responses from readers have indicated general interest in the subject. In the present discussion, the law is clarified as applying to labels, trademarks, copyrights and patents, and the procedure relating to each is reviewed.

A design patent may be obtained by any person who has invented any new, original and ornamental design for an article of manufacture. It is granted for a term of three and one-half years or seven years or fourteen years, as the applicant may specify in and at the time his application is filed, or at any time before the allowance of the patent. The government fees vary in accordance with the length of the term.

In design patents it is merely the appearance of the article which is sought to be patented, and reference is had only to the exterior surface of an article. Interior views are not proper subjects for design patents. In the drawings made for the Patent Office a sectional view is permissible only if it is necessary to bring out features of the invention which otherwise might not be clear.

Since design patents relate to the appearance of an article which must be ornamental, a mechanical device or a part thereof is not the subject of a valid design patent. It is immaterial that the subject of a design patent may embody a mechanical device providing the appearance or design is pleasing, attractive, novel, useful and the result of invention; but to attempt to obtain a design patent merely on the shape of a machine is invalid.

The rules relating to applications for mechanical patents apply to design patents, and the applicant must describe the article in full, clear, concise and exact terms as will enable persons skilled in the art to work and use the invention. However, inasmuch as a drawing is a part of the application for a design patent it differs from other applications for patents in that a written description of the article is unnecessary where the drawing or photograph attached clearly shows the design. In fact, a design should not be described in writing since a drawing is its description, but there is no hard fast rule governing this point as this is left to the examiner, and if a written description is necessary he may call for it.

Rules which govern infringement of design patents do not apply to mechanical and other patents, because any person who infringes a patented design is liable to the patentee in the amount of not less than $250.00, or if the sale or manufacture has added a profit of over that amount, the infringer is liable for all the profits.

The test of infringement is whether the two designs in litigation are so alike as to appear identical to the eyes of an ordinary observer and not whether differences can be observed by an expert.

Mechanical Patent Infringement

Any person or firm who infringes a mechanical patent is liable to the patentee for full profits earned, plus all damages caused the patentee. But under no circumstance is a mechanical patent infringed unless the "claims" are infringed. The fact that the drawings are infringed does not result in liability. This rule differs from the law relating to design patent infringement where the drawings must be infringed.

With respect to a mechanical patent, a patentee is entitled to all the practical uses of his device, and all of the functions that it will perform, whether or not he was aware of or described them while he procured his patent. He is not required to point out and distinctively claim the different uses to which the invention may be applied, because a mechanical patent is construed, when possible, to cover the

entire invention thought of by the inventor.

However, a patentee is bound by his claims and he cannot in an infringement suit ask for a broader construction than listed in his claims even though he may have been entitled to broader claims when the patent application was in the course of prosecution. At no time will the court expand a claim or claims in favor of a patentee, as the inventor will be protected only according to the terms of his claims. It does not matter how manifest the fact or extent of the mistake may be shown to have been in wording the claims incorrectly. Moreover, the specification cannot be read into the claims for the purpose of broadening them. In other words, a claim is a definition of the invention and it is necessary in proving infringement of a patent to prove infringement of a claim. Also, it must be proved that the particular thing alleged to be infringed is described in the specification and clearly shown in the drawing.

Each Claim Separate Patent

The rule is that each claim of a patent covers a complete invention in itself and an independent invention.

The correct method for writing strong and basic claims is to have each claim specify some particular step or advantage, and when a claim is poorly drawn and includes an element or part immaterial to its structure, the inventor is not permitted by the court to show that the element is immaterial when attempting to make out an infringement suit. However, where all of the elements are not included in a claim, the claim is valid, although the specification or description does not explain that the element may be omitted. Therefore, the shorter the claim and the fewer the elements contained in a claim the better. It is more liable to be infringed by a person who attempts to copy the device.

Substitution of Parts

It is in favor of the inventor, when defending his patent against infringement, if he can prove that his invention is meritorious. Moreover, a person cannot avoid infringement by substituting ordinary parts.

For instance, a pair of sprocket gears having an endless chain may be referred to in a claim, and the substitution therefor of a pair of intermeshed gears will not avoid infringement. This is because an inventor is protected not only against the exact part claimed but also he is protected against the equivalents therefor and vice versa. On the other hand, when the word "means" is used in a patent claim it does not broaden the claim to "any means" which may be used for that purpose, but is held strictly to what is disclosed in the drawings or specification and the equivalents thereto.

Still another important point of law is that an inventor has the privilege of using words adapted to express his particular intended meaning, and these words have the desired meaning as intended by him and not the meaning as given in a dictionary. In other words, an inventor may not only "invent" new devices which he may patent, but also he may invent new methods and words for explaining the uses and construction of his patented device.

The reason the law presently is established in this manner is because the courts always endeavor to afford the inventor the protection to which he is entitled. And he cannot be penalized simply because he fails to explain his invention in terms thoroughly understood by all persons. This advantage of law is particularly important when it is considered that an inventor, who in anticipation of filing an application for a patent may record or explain his inventions on papers intended to be utilized at a subsequent date to establish priority. He can use his own terms and expressions, when describing his invention, and need not worry about difficulties or chances of losing his invention or patent because he failed to use technical terms.

When Patent Is Infringed

Although a patent is infringed the patentee may not be awarded a verdict. Various higher courts have held that to sustain a suit for infringement, and be awarded damages and profits the suit must be brought by the patentee within a reasonable time. For illustration, a delay of six years or less time should not bar recovery unless under special circumstances, and a delay of three years, where the inventor was not in a position to bring suit, is not too long, but ten years delay has been held not reasonable under ordinary circumstances unless suit has been brought against another infringer during that time. However, where a pioneer or basic patent has been infringed for as long as ten years, without interference by the owner of the patent, the patentee may stop the infringement but cannot recover damages.

Damages and Profits

No damages may be sustained by a patentee before a patent is allowed but after it is allowed damages may be sustained from the date of allowance. Therefore, anyone may make a device which is marked "Pat. Aply'd For" and not yet patented.

Actual damages for infringement of a patent may be measured by a reasonable royalty basis, or the court may decide the amount of damages by the evidence submitted. Generally, the inventor must either prove the profits made by the infringer, or the net profits the inventor would have earned if the patent had not been infringed. If this cannot be done, only nominal damages are recoverable which is usually $1.00 and the costs.

If the infringement is for a patented improvement or a part of an article or machine, then only damages and profits relating to the particular part infringed may be recovered by a patentee.

The courts have repeatedly held that a pioneer or basic patent should be liberally and broadly construed in favor of the inventor, and that all subsequent devices which employ substantially the same mode of operation are infringements. This does not mean, however, that no other person may be permitted to per-

form the same function by other and different means.

Still another important matter is that late rulings of the higher courts have held that an inventor may lose his right to an invention by delay in perfecting the same and delay in filing an application for a patent. However, the non-use of a patented device does not weaken the patent. In other words, the owner of a valuable patent may refuse to licence its use, and, in fact, he can refuse to benefit the public by use of his invention during the entire seventeen years life of the patent.

Notification Not Necessary

Modern courts hold that it is not necessary to notify an infringer to discontinue the infringement of a patent before bringing suit, if the goods have been properly marked by the patentee as required by the statutes. But, where the goods are not properly marked, no damages may be had for infringement until the infringer has received notice from the patentee. If he continues to infringe after receiving the notice damages may be recovered for sales made, and articles manufactured, since the date of the notification. The profits of the infringer, however, may be sustained even though the patented article was not properly marked and no notification was given.

Power Recovered in Testing Airplane Engines

Prior to 1940 the power produced in testing airplane engines was absorbed by propellers, water brakes, electric brakes, etc., but as the sizes and number of such engines increased, the fuel consumed in production testing began to represent a tremendous waste and the disposition of this energy presented an increasing problem. Today it is being recovered in a number of plants to perform useful work in the manufacturing operations and supplies more than half their power needs. The means employed were described in a paper by Messrs. Cassidy, Mosteller and Wright, of the General Electric Company, before the Winter Meeting of the A.I.E.E. at New York, January 25–29.

In the original installation, placed in operation by Pratt & Whitney in the spring of 1940, a synchronous machine with a hydraulic slip coupling was employed. This synchronous machine serves as either a motor or a generator. It is equipped with an amortisseur winding and is started and connected to the line in the conventional manner as a synchronous motor. During starting, the coupling is set to transmit no torque, so that the engine remains at rest. After being brought up to speed and synchronized, the coupling is controlled so as to make the synchronous machine turn the engine. The latter, after being warmed up, is put under its own power and brought up to a speed above that of the synchronous motor. The latter acting as a generator, then, loads the engine on the power system by slipping in the coupling, and the major portion of the power is made available for useful work.

Another application of this scheme was made some months later in the first of three aircraft engine plants to be erected by the automobile industry.

In the second of these plants, a magnetic slip-coupling of the eddy-current type was employed instead of the hydraulic slip-coupling; and in the third, and most recent of these plants, wound-rotor induction generators were used. At present, a large number of such power-recovery testing systems are in use or on order.

From the standpoint of individual engines, records show that for each engine of large rating coming off the assembly line, there is recovered from 3000 to 6000 kwhr. A tabulation of overall plant performance for a six months' period showed power recovery exceeding half that required to operate the plant during that period.

Figures were also offered showing a considerable saving in critical materials (copper and steel) through use of such a power-recovery system as compared with equivalent power supplied by steam-electric generating plant capacity.

Care of Motors

Electric motors regularly serviced will give dependable, long-time use; but neglect leads to breakdowns with consequent interruptions in production and, perhaps, to fire. The following rules of motor maintenance are listed by the Safety Research Institute:

1. Open-type motors should be blown out weekly; those operating under severe conditions, daily. Use no more than 50 lb pressure to avoid possible damage to insulation.
2. Follow manufacturer's instructions in lubricating motors. Too much oil is as bad as too little, causing deterioration of insulation.
3. Inspect bearings weekly or more often. Feel temperatures, examine for excessive end play, and make certain oil rings are working.
4. Inspect brushes and commutators weekly or more often. Make certain brushes are seated perfectly and commutators are smooth. Use proper grade of carbon brushes to prevent wear of commutator and reduce sparking.
5. Where motors operate with excessive belt tension, check the air gap between rotor and stator every week. A monthly check of motors in average use is sufficient. Difference in the width of the gap around the circumference of the rotor will indicate the extent of wear on bearings.
6. Where motor leads are exposed to view, check them weekly to see that connections are tight, well insulated and protected, and free from oil.
7. Inspect ground connections weekly, keeping them tight and in good condition.

This is for the protection of employees, and for the proper operation of overcurrent protective devices.

8. Set up a regular schedule for overhauling motors. Most motors should be overhauled annually, while those in severe use should be overhauled twice a year or more often.

9. Dismantle the motor for a complete overhaul job. Wash all parts with carbon tetrachloride or some other safety solvent. Paint the windings with a good, oil-resisting insulating varnish.

10. Keep the area around the motor as clean as the motor. Arcing frequently ignites oily material that has not been cleaned up.

11. When fire breaks out in or around a motor, shut off the power before attacking the flames, if possible. Do not depend upon the circuit-breaker operating or a fuse blowing out, but shut off the power. This will minimize damage to the motor and prevent continued arcing from reigniting the fire. When the motor or conductors are dead, direct the fire extinguishing agent into the motor or upon whatever is burning, just as in any other fire. As soon as the fire is out, ventilate the area thoroughly to clear out smoke and fire gases.

Greater Standardization Advocated for British Boiler Practice

In his presidential address before the Institution of Mechanical Engineers, London, as reported in a recent issue of *Engineering*, Col. S. J. Thompson advocated greater standardization of power boilers.

"A few stations could be selected for research and further development of higher steam pressures and temperatures, etc." he said, "but engineers seem almost to compete with one another in steam pressure, superheat and ancillary plant, and this has increased the cost of installation. The capacity of steam plants appears to vary considerably, and very little attempt is made to use standard units. This practice necessitates the preparation of a large number of special drawings, which work could be curtailed if certain standards were generally adopted."

Colonel Thompson then suggested that three or four heat cycles be considered with a view to standardizing steam pressures, steam temperatures, feed-water and air temperatures, the sizes of boiler units also being considered as far as possible in increments of 50,000 lb of steam per hour. The following table was suggested as a tentative standard:

Steam Press., psi	Steam Temp., F	Feed Temp., F
250	750	220
425	825	260
650	825	300
850	900	350

Air temperatures of 275 to 300 F were suggested for stokers and around 500 F for pulverized coal.

Although the average size of turbine-generators now being installed in England is 30,000 kw, there are indications that 50,000 kw may represent the average size in the future, with as high as 100,000 kw in individual cases. The larger sizes would be accompanied by larger boilers with capacities of 300,000, 350,000, or even 500,000 lb per hr.

Commenting upon *availability*, Colonel Thompson observed that there appears to be a tendency to embody too many "frills" which not only increase the capital cost but also the operator's troubles, and, at times, necessitate complete shutdown of the steam generating units. During such times large capital investment is standing idle. Continuing, he said:

"It must be appreciated that in designing a boiler plant for very high efficiencies, say, 87 to 89 per cent (based on the gross calorific value of the fuel), low exit gas temperatures are necessary. From such low temperatures corrosion may arise, also deposits in the air heaters, which may cause the plant to be shut down and thereby reduce the availability. It thus appears to be more important to install a plant in which, by permitting a little lower efficiency, the availability is increased and the cost of maintenance reduced to a minimum."

James D. Harrison Dies

James Duncan Harrison, for a number of years Manager of the Chicago District Office of Combustion Engineering Company and widely known in power circles in the Middle West, died at the Barnes Hospital, St. Louis on February 11. He had been in poor health for several months.

Born at Williamsport, Pa., in 1883, Mr. Harrison joined Combustion Engineering Company in 1915 and had been in charge of the Chicago District since 1922. He was a member of numerous organizations including the Union League Club and Illinois Country Club. Surviving is his daughter, Mrs. Dorothy Minto of Springfield, Mo.

Personals

Nevin E. Funk, Vice-President in charge of engineering of the Philadelphia Electric Company has been nominated as President of the American Institute of Electrical Engineers. He will take office on August 1.

Louis Kahn has been elected President of Albert Kahn Associated Architects and Engineers, Inc., of Detroit. He has been associated with this organization since 1909 and fills the office recently vacated by the death of Albert Kahn.

Harry S. Wheller was elected President and General Manager of the L. J. Wing Mfg. Co. at a recent meeting of the Board of Directors of that company. He had been Vice-President since 1917, and succeeds the late Alfred E. Seelig.

J. W. Belanger has been appointed Manager of the Federal and Marine Department of the General Electric Company.

REVIEW OF NEW BOOKS

Any of the books here reviewed may be secured through Combustion Publishing Company, Inc., 200 Madison Ave., N. Y.

A.S.T.M. Specifications for Steel Piping Materials

For the first time, the American Society for Testing Materials has compiled in one compact volume all of its specifications covering steel piping materials, most of the standards having been developed through the work of Committee A-1 on Steel. Ten of the specifications cover boiler, superheater and miscellaneous tubes, many of which are incorporated in the A.S.M.E. Boiler Code and other codes. The Society's work in the field of piping has been outstanding, and there are 15 specifications covering various types of pipe for service at normal and high temperatures.

The A.S.T.M. Steel Committee is in close cooperation with the petroleum industry and has carried out important standardization work on still tubes for refinery service and heat-exchanger and condenser tubes, there being five standards for these materials. There are five specifications covering castings which are widely used for valves and related materials, four pertain to forgings and fittings, three cover carbon and alloy-steel nuts and bolting material, and for convenience the standard austenite grain size chart (E 19) is embodied in the book. For convenience all specifications and tests are arranged in numeric order of the serial designation with a Table of Contents listing the specifications according to the material covered, that is pipe, bolting, castings and so forth.

To expedite procurement and conserve critical and strategic materials, many A.S.T.M. emergency alternate provisions have been issued in the piping field. These provisions are incorporated as part of this 256-page publication. Price $1.75.

Statistics of Electric Utilities in the United States—1941

Issued by the Federal Power Commission

This 500-page volume is the fifth annual edition of Statistics of Electric Utilities—Classes A and B, issued by the Federal Power Commission. The book gives detailed financial and operating information on 374 utilities representing, on the basis of either assets or revenues, in excess of 95 per cent of the privately owned electric utility industry in the country. The statistics given have been compiled from reports filed with the Commission by all utilities receiving annual electric revenues of $250,000 or more.

The publication shows for each utility: balance sheets, income and earned surplus accounts, capital stock and bonds, electric operating revenues, customers and sales by classes of service, operating expenses, utility plant accounts and data as to physical quantities. These are broken down to reveal the operations and costs of the individual companies on a functional basis to permit the comparison of virtually every characteristic of a company's operating or financial practices and results with corresponding factors in the management of any other company. Holding company relationships are also indicated.

The book is bound in blue cloth and is sold at $2.00 a copy by the Federal Power Commission only, to which all orders should be addressed, enclosing check or money order. For convenience in ordering, the publication may be referred to as "FPC 5-25."

Questions and Answers for Marine Engineers, Book I—Boilers; Book II—Engines

Compiled by Captain H. C. Dinger, U.S.N. (Retired)

During the past decade *Marine Engineering and Shipping Review* has published "Questions and Answers" as a means of imparting practical information regarding many boiler and engine-room problems. These have been collected and classified in a series of booklets. Book I—Boilers, and Book II—Engines, are now published and both of these indicate that this will be an exceedingly helpful series for marine engineers and operators, and particularly those going up for license examinations.

The questions and answers have been grouped according to subjects and their subdivisions. In some instances somewhat similar questions are answered in a similar manner but modified to bring out information of interest or value. Both volumes are completely indexed and explanatory notes and dates have been added where clarification was considered necessary.

About one-third of the book on Boilers is devoted to fuel and combustion problems. Other subjects dealt with in this volume include: Inspection and Tests, Accidents, Repairs, Safety Valves, Superheaters, Operations and Accessories, Water Control, Feeding and Blowdown, Feed Heating, Heat Recovery and Evaporation. The book on Engines covers all types now in use and devotes considerable space to the subject of Turbines. Other subjects dealt with in this volume include: Reciprocating Engine Features and Operations, Reduction Gearing, Pistons and Cylinders, Valves and Valve Setting, Engine Adjustments, Bearings and Adjustments, Miscellaneous Features and Indicator Cards.

Books I and II comprise 168 and 186 pages, respectively, size $5^1/_8 \times 8^1/_8$, bound in paper covers. Price $1.00 each.

Essential Mathematics for Skilled Workers

By H. M. Keal and C. J. Leonard

This book is particularly suited to the needs of men of average education who wish to brush up on their mathematical knowledge and know how to use this knowledge in their work. It is a practical book for the industrial worker and gives a brief, clear-cut working knowledge of arithmetic, algebra, geometry, logarithms, numerical trigonometry and the slide rule, with constant reference to their use in various technical fields and trades.

The book is profusely illustrated and contains 293 pages, size $4^7/_8 \times 8$, bound in cloth. Price $2.00.

Substitutes

By H. Bennett

This book should be of interest to all branches of industry where shortages are an everyday problem. It describes new products, processes and substitute materials, and alternatives for the numerous raw materials which have become unavailable because of the war. The author is an expert in this field and has not only given of his wide knowledge of substitutes but has also included the results of the extensive experience of many chemists, engineers and technical workers.

The contents include: substitutes for metals, plastics, textiles, rubber, chemicals, drugs, resins, waxes, paints, oils, fats and many other products. A plan is given which shows how to determine whether a substitute is suitable or not, and whether it will stand up under conditions of marketing and use. Price $4.00.

The Organization and Training of Industrial Fire Brigades

By Captain John C. Klinck

The training of industrial fire brigades was an important undertaking in time of peace, but now that we are at war, the protection of American industries and business property becomes an urgent necessity. Private fire brigades can and should be developed to lighten the load of public fire departments in the present emergency.

This manual has been prepared expressly for the use of fire department officers who are faced with the problem of organizing and training private fire brigades within industrial plants, storage warehouses and other large buildings. It shows how such a force can be organized and provides a thirty-hour course of training in the fundamentals of fire-fighting. The instruction contained in the text is amply supported by more than 150 drawings which admirably illustrate the theory of fire-fighting and the use of fire-fighting equipment.

The book contains 120 pages and is bound in red paper covers; size 6 × 9. Price $1.00.

NEW CATALOGS AND BULLETINS

Any of these publications will be sent on request

A-C Welding

A complete line of Flexarc A-C Welders, with current ratings from 100 to 500 amperes, is described and illustrated in a new 12-page bulletin (B-3136) issued by Westinghouse Electric & Mfg. Company. Featured are the 500-ampere industrial welder for high-speed, continuous welding on all types of heavy construction, and the 300-ampere portable welder for heavy duty work. Both models have built-in power-factor correction.

Air Blowers and Exhausters

A new 12-page bulletin (1-100) on air blowers and exhausters, gas boosters, and industrial vacuum cleaning systems has been published by Allen Billmyre Corporation. The bulletin is profusely illustrated and concisely describes many types of turbo and rotary blowers, and also stationary and portable vacuum cleaners for industrial plants.

Care of Centrifugal Pumps

Allis-Chalmers Manufacturing Company has just released another maintenance manual—"Handbook for Wartime Care of Centrifugal Pumps." This is a 28-page booklet and is abundantly illustrated with sketches and diagrams. Valuable tips given in the booklet describe: How to pack stuffing boxes; how to figure head; protection against cavitation; causes and cures for pump trouble.

Combustion Control

"Selecting Controls for Fuel Conservation" is the title of a new 16-page publication issued by The Hotstream Heater Company. This is an informative manual on both coal and oil firing and it explains in simple terms the fundamental principles governing the burning of fuels as applied to different methods of firing. In order to effect the most efficient use of the fuel suggestions are given regarding the selection of control equipment. Typical installations illustrated and described include hand-fired natural and forced-draft units; underfeed, chain-grate and spreader stoker fired units; and also units with automatic, semi-automatic and manually controlled oil burners.

Conductivity Apparatus

A 4-page folder has been issued by Industrial Instruments, Inc., featuring its line of Solu-Bridge measuring and control instruments and accessories. The bulletin (RD-104) is illustrated and complete test and control assemblies are listed for steam condensate and for boiler water.

Coal Handling Machinery

Robins Conveying Belt Company has issued an attractive 24-page bulletin (No. 121) presenting its line of Robins Mead-Morrison bridges and towers and special rigs for handling coal, ore and other bulk materials. The bulletin is beautifully illustrated with photographic halftones and pictorial diagrams, and the equipment described includes man-trolley bridges for grab capacities up to 10 tons and rope system bridges for grab capacities up to 7 tons. Also featured are: Type R unloading towers, Type C unloading, stocking and reclaiming towers; traveling and stationary car dumpers; car hauls and barge hauls; rail clamps, and cable railways.

Graphite Lubrication Handbook

Nassau Laboratories, Inc. has just issued the second edition of its "Graphite Lubrication Handbook." This is an informative 28-page booklet on colloidal graphite lubrication featuring this company's line of standard Cograph concentrates. Sixteen Cograph products are described and specific information regarding the use of these is contained in a comprehensive Indexed Guide to Better Lubrication which occupies 17 pages of the book. A price list is also given.

Hot Process Water Softeners

Graver Tank and Manufacturing Company has issued a 24-page bulletin (Form 314) describing its line of lime and soda hot process water softeners. This is a colorful catalog which fully describes the operation of the Graver equipment, including filters, chemical feeders and other accessories. It is illustrated with many installation views together with cross-sectional views and diagrams of the various types of equipment. Charts and tables of pertinent engineering data are also included.

Properties of "K" Monel

The International Nickel Company has issued an informative 16-page bulletin (T-9) presenting the engineering properties of the corrosion-resistant wrought alloy of nickel, copper and aluminum known as "K" Monel. The bulletin includes 9 charts and 18 tables pertaining to the text and 8 photographic illustrations showing typical applications of this alloy. The text covers: composition, physical constants, properties, working instructions, thermal treatment, corrosion resistance, mill products, range of mill sizes and application.

Pumps

Economy Pumps, Inc. has issued an 8-page catalog (D2-1042) featuring its new Type SCV pump. This unit, which is characterized by the vertical mounting of the motor, is available in various sizes for capacities ranging from 10 to 500 gallons per minute. Illustrations include sectional and assembly views. Dimension and selection tables are also given.

Proportioning Equipment

A 4-page folder (Form 312) describing the Graver line of chemical mixing tanks, chemical proportioners and remote control chemical proportioners has been issued by the Graver Tank & Manufacturing Co. The folder is illustrated and includes tabulations of tank dimensions and meter applications.

Thermometers

Wheelco Instruments Company has issued a 12-page bulletin (G23-2) which discusses the operating principal of Wheelco thermometers and gives information to aid the user in selecting the proper instrument for his application. A table gives complete details on the characteristics, performance and limitations of each class of vapor-pressure and gas-filled instruments. Similar information to aid in selection of bulb and socket materials, and of capillary and its armor, is also included. Available scales for indicating instruments, and charts for recording instruments are illustrated.

Wrought Iron Piping

A new 36-page technical bulletin entitled "Wrought Iron for Underground Services" has just been released by the A. M. Byers Company. This booklet discusses the important factors effecting soil corrosion of underground piping, weighs theory against test results and outlines installation histories of water wells and lines, oil and gas wells and lines, gasoline lines and tanks, and electrical cable conduit. The booklet includes many photographic illustrations of underground piping installations under varied conditions in major cities throughout all parts of the country.

Effect of War Time on Load

The War Production Board has been making studies on an area-wide basis of the savings in energy production and peak load demands through application of "war time." In a memorandum to U. S. Senator Homer Ferguson of Michigan and to Speaker McCullock of the Ohio House of Representatives, in both of which states there has been some agitation for a change in time, Chairman Nelson of WPB quotes figures for the major utility systems in those areas. These figures are as follows:

Michigan	Annual Kilowatt-Hour Savings	Reduction in Peak Loads, Kw
Consumers Power Company	42,000,000	25,000
Detroit Edison Company	69,300,000	70,000
Lancing Municipal System	3,700,000	5,000
Total	115,000,000	100,000
Ohio		
Cleveland Electric Illuminating Co.	20,100,000	
Cleveland (Ohio) Municipal System	3,000,000	
American Gas & Electric Co. (Ohio Div.)	15,400,000	4,000
Central Ohio Light & Power Co.	900,000	
Columbus & Southern Ohio Electric Co.	8,200,000	2,000
The Toledo Edison Co.	7,300,000	1,000
The Ohio Public Service Co.	6,200,000	1,000
Marion-Reserve Power	1,200,000	
Columbus (Ohio) Municipal System	600,000	
Cincinnati Gas & Electric Co.	14,500,000	3,000
Ohio Edison Company	14,800,000	3,000
Dayton Power & Light Co.	6,900,000	1,000
Hamilton (Ohio) Municipal System	900,000	
Total	100,000,000	15,000

BOOKS

1—Heat Transmission
(Second Edition)

By William H. McAdams

459 pages — Price $4.50

It has been ten years since the first edition of this well-known book appeared as a text for students and a reference for practicing engineers and designers. Since then much research, improved methods of investigation and many new developments have enriched the knowledge concerning heat transmission. However, because of its breadth of application the results are widely scattered in the technical literature of many fields. Much of this has here been digested and correlated with the fundamentals in a form most useful to the designing engineer. This applies especially to graphical methods.

For convenience, the basic assumptions and general background of the derivations have been divorced from the mathematical presentation and are given in the main text, whereas the mathematical treatment is in fine print. Chapters are devoted to conduction, heating and cooling of solids, radiant heat transmission, dimensional analysis, flow of fluids, heat transfer between fluids and solids, the heating and cooling of fluids inside tubes and outside tubes, condensing vapors, heat transfer to boiling liquids and applications to design. The Appendix contains numerous tables and charts and a very extensive bibliography is included.

2—Mechanical Engineers Handbook
(Fourth Edition)

By Lionel S. Marks

2274 pages — 5×7 — Price $7.00

Mechanical engineers will welcome the new 1941 Edition of this standard handbook as eleven years have elapsed since the appearance of the previous edition and in the interim far-reaching advances have been made in many branches of mechanical engineering. The present volume represents the work of more than 90 contributors, each a specialist in the particular subjects covered, and many of the chapters have been completely rewritten, only basic material having been retained from the previous edition.

3—Plant Protection

By E. A. Schurman

148 pages — $5 \times 7^1/_4$ — Price $2.00

Industrial plant protection has become a specialized branch of modern police science. The essence of the work is prevention rather than investigation of crimes already committed, and the recognized menace of spies, saboteurs and fifth columnists compels established or newly organized police departments to adopt new methods ensuring more adequate security.

The author, E. A. Schurman, Chief of the Protection Department of the Glenn L. Martin Company, is a recognized authority on this subject, and in this book nothing has been recommended which has not survived practical application by organizations whose efficiency of operation is widely known.

4—The Marine Power Plant

By Lawrence B. Chapman

402 pages — Price $4.00

In the second edition of this excellent text, the student will find a short but direct and thorough introduction to the fundamentals of the selection and design of steam and diesel propulsion plants. The marine engineer will find it refreshing with many helpful guides to design procedure and computation and to revealing comparisons for the proper selection of equipment. Owners and operators will find it similarly useful, and in addition may utilize it to check the results and correct the operation of their vessels.

Fundamentals and thermodynamic principles are set forth in a manner easily comprehended and descriptions of marine equipment are handled with clarity. In the selection of equipment, the latest practices are brought out but sight has not been lost of installations of the recent past—of ships that will be in operation for some years to come.

There are chapters on Fuels, Marine Boilers, Combustion, Reciprocating Steam Engines, Geared Turbines, Turbo-electric Drive, Diesel Engines, Comparisons of Types of Propelling Machinery, Condensers and Their Auxiliaries, Power Plant Layouts, and Computations for the Power Plants of Merchant Ships.

5—Elements of Heat Transfer and Insulation

By Max Jakob and George A. Hawkins

169 pages — $6 \times 9^1/_4$ — Price $2.50

With this new text the authors present the fundamentals of heat transfer in a simple, easily followed manner. Intended primarily as a textbook for the instruction of junior and senior students in engineering, it apparently embodies the authors' ideas of presenting this important subject.

The arrangement of the material follows quite generally the conventional presentation. Starting from the concept of Thermal Conductivity, the student is led quickly but easily through Conduction in the Steady and Unsteady States, Dimensional Analysis, Free and Forced Convection, and Radiation, to the application of these methods in combination. This is followed by useful comments on experimental determination of data and correction of heat measurements. The work is concluded by a brief introduction to the relations between heat transfer and fluid friction.

6—Welding Handbook

1593 pages — 6×9 — Price $6.00

The growing importance of welding as an industrial tool in the construction of ships, tanks, planes, guns, munitions and machinery necessitates the publication of a handbook for general up-to-date information on the subject of welding, and the American Welding Society has met this need by providing an authoritative work of reference on the technical phases of welding. The text is arranged in handbook style; nevertheless the material is in a logical sequence with enough explanatory matter to be used as a textbook in engineering schools or as a reference book in trade schools. The volume covers the physics and metallurgy of welding and the weldability of steels; the welding and allied processes; the materials used; training, inspection and safety; design considerations, the testing of welds, and the applications of welding.

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